

National Unmanned Aircraft Systems (UAS) Project Office

The USGS National Unmanned Aircraft Systems (UAS) Project Office and the Department of the Interior Office of Aviation Services (OAS) are leading the development and testing of UAS scientific and resource management technology across the Department, in coordination with the other bureaus. DOI UAS capabilities support a range of activities, including scientific research; monitoring environmental conditions; analyzing the impacts of climate change; responding to natural hazards; understanding landscape change rates and consequences; conducting wildland fire assessment; wildlife inventories; search and rescue; and supporting related land management and emergency response missions. The USGS and OAS are also working across the Federal Government with NASA, NOAA, DHS and DoD, and with Academia on evaluation of UAS capabilities.

Wildlife Management

The initial USGS mission in March 2011 studied the annual north-south migration of Sandhill Cranes from Arizona through Colorado to Montana and Wyoming. The cranes fly north in the first part of February and spend much of each Spring in Colorado's San Luis Valley at the Monte Vista National Wildlife Refuge. Thermal cameras



capturing images of the cranes at roost were used to determine population trends in collaboration with the U.S. Fish and Wildlife Service. Because the Raven is small and quiet, it could fly low enough (75-100 feet), to photograph the birds without disturbing them. Moreover, the mission costs are being estimated at approximately one-tenth the cost of conventional aerial surveys.



Raven Infra-Red Thermal Imagery of Roost, Black is Hot, taken 6:39 am 3/24/11.

Public Safety and Research

The UAS Project Office partnered with the Office of Surface Mining, Reclamation and Enforcement (OSMRE) to help with permitted inspections of dangerous mines and mines with difficult areas of access in West Virginia. Inspectors measured the amount of coverage collected via UAS platform compared the results to traditional ground based inspection methods to compare efficiency.



Raven Imagery over Glines Canyon Dam, Olympic National Park, WA

Former Elwha River Boundaries



T-Hawk flight logs provide an inspection history and record for mine safety inspectors.

USGS, Bureau of Reclamation and the National Park Service explored the potential of UAS technology for monitoring fish, river sediment, and vegetation changes during one of the largest controlled releases of sediment in North American history at Lake Aldwell and the Elwha River.

System Platforms



RQ-11(A) Raven



RQ-16 T-Hawk

UAS systems currently utilized by the Project Office.

The USGS fleet includes several 4.5-lb battery-powered, hand-launched AeroVironment Ravens and T-Hawk Honeywell helicopters, which operate on only a few ounces of fuel. Each type of craft can fly for approximately an hour. Initially used with their military-issue forward-looking and downward-looking cameras, the USGS has modified the systems to take advantage of low cost technology such as the GoPro Hero 3 and Canon Powershot cameras, and is evaluating a range of sensors for specific scientific missions. CO2 sensors can be used for climate-change studies, while synthetic aperture radar would allow the craft to fly in low visibility conditions

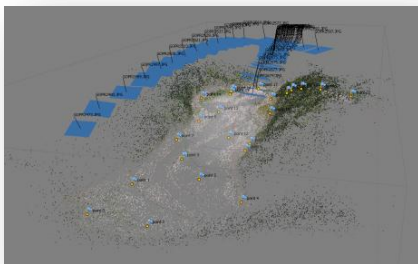
and provide change detection over a study area. Thermal sensors detect relative temperature differences and are useful for fire studies, water discharge and animal detection.

Current Enhancements:

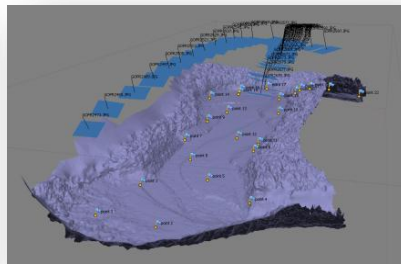
- GoPro Hero 2 & 3 - 1080P HD camera (stillframe and video)
- Canon SX260HS – GPS enabled (RGB and IR) – CHDK
- Canon SX230HS – GPS enabled (RGB and IR)
- I-buttons (temp. & humidity)



Geospatial Products from UAS Data



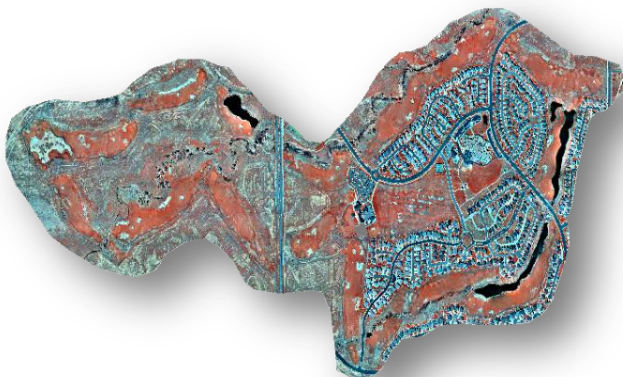
Point Cloud



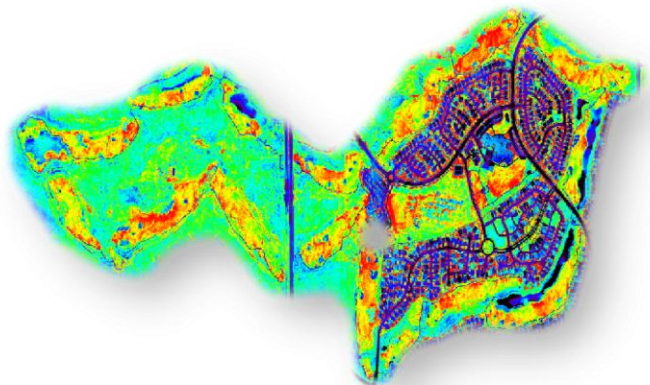
Digital Elevation Model



Ortho Imagery



Color Infrared – (red, green, blue)



Color Infrared & Normalized Difference Vegetation Index (NDVI)

$$NDVI = \frac{(near\ infrared - visible)}{(near\ infrared + visible)}$$